CLAIMS:

1. A network device comprising:

at least one network port;

a masks table containing filter information and a mask key;

a rules table having corresponding rules to said filter information and being related to said mask table by said mask key;

a pointers table containing boundary data related to said rules for corresponding filter information; and

a fast filter processor coupled to said mask table, said rules table and said pointers table, and configured to perform at least one binary search for at least one rule related to a data packet received by said network device at said at least one network port, said binary search being limited based on said boundary data in said pointers table.

2. The network device of claim 1, wherein said filter information in said rules table is sorted in order, said pointers table contains addresses of maximum and minimum rules in said rules table for each specific mask key value, and wherein said fast filter processor is configured to calculate parameters of said at least one binary search based upon said addresses of maximum and minimum rules in said rules table for each specific mask key value.

3. The network device of claim 2, wherein said fast filter processor

is configured to receive said packet and AND said packet with at least one of said filter information related to a single mask key to generate a product, to calculate the parameters of said at least one binary search based upon said addresses of maximum and minimum rules in said rules table for said single mask key value, and to retrieve at least one rule from said rules table based on the results of said at least one binary search based on said product.

4.   The network device of claim 1, wherein said fast filter processor comprises semiconductor-based processor components.

5.   The network device of claim 3, wherein said fast filter processor is configured to loop through every mask key for said filter information, to AND each of said filter information with said packet, to initiate a binary search for each product, and to store all results of each said binary search.

6.   The network device of claim 1, further comprising:

a CPU coupled to said fast filter processor, said rules table, said mask and said pointers table, and configured to store and maintain data in said rules table, said masks table and said pointers table, and to create said minimum and maximum address information in said pointers tables based on inserts and updates to said masks tables or said rules tables.

7.   The network device of claim 2, wherein said parameters include

number of search steps, search start address and delta per step.

8.   A fast filter processing circuit, comprising:

a rules table having an input and output, and configured to store rules related to a network function;

a masks table having an input and output, and configured to store masks related to said rules;

a pointers table having an input and output;

a signal generator coupled to said masks table and said pointers table, and configured to generate a next mask signal;

a multiplier coupled to the output of said masks table and to a data packet input, said multiplier configured to multiply a mask output from said masks table and a data packet input from said data packet input and to output a product of said mask and said data packet;

a comparator coupled to the output of said rules table and the output of said multiplier, and configured to compare said product with a rule output from said rules table and to generate a comparison signal;

a multiplexer having a plurality of data inputs and a control input, said control input coupled to an output of said comparator, said multiplexer configured to output an address signal being one of said plurality of data inputs based on said comparison signal input to said control input;

a feedback loop coupled to the output of said multiplexer and the input of said rules table, to a first input of said comparator, to a subtractor and to an

adder;

wherein data in said pointers table defines a number of steps for a search and a starting address for said search, said subtractor subtracts a jump value from an input and outputs an address less than a current address by the jump value to a second input of said multiplexer, said adder adds said jump value to an input and outputs an address greater than a current address by the jump value to a third input of said multiplexer, and said circuit outputs said output of said rules table, such that a rule matching said data packet based on said mask is output of said circuit.

9.   The circuit of claim 8, wherein said multiplier comprises an AND gate.

10.   The circuit of claim 8, wherein said comparator is configured to output a first comparison signal when said rule and said data packet input to said comparator match, and said multiplexer is configured to output a signal from a first input of said plurality of data inputs, said first input signal being a current address of said search.

11.   The circuit of claim 8, wherein said comparator is configured to output a second comparison signal when the value said rule input to said comparator is less than the value of said data packet input to said comparator match, and said multiplexer is configured to output a signal from a second

input of said plurality of data inputs, said second input signal being a next address of said search.

12. The circuit of claim 8, wherein said comparator is configured to output a third comparison signal when the value said rule input to said comparator is greater than the value of said data packet input to said comparator match, and said multiplexer is configured to output a signal from a third input of said plurality of data inputs, said third input signal being a next address of said search.

13. The circuit of claim 9, wherein when said rule and said data packet match, said rule output of said circuit is held at a current rule for said current address for a remainder of search steps.

14. A method of filtering a packet in a network device, said network device having a data packet input port and configured to perform at least one network function, said method comprising the steps of:

providing a masks table, a rules table and a pointers table;

relating mask data in said masks table to rules data in said rules table with a key, one of said mask data corresponding to one or more of said rules data;

defining pointer data in said pointers tables defining a maximum and minimum address of corresponding rule data for each of said mask data

receiving a data packet at said data packet input port;

multiplying said data packet with one of said mask data to produce a product;

searching said rules table based on said product and said maximum and minimum address data for said one of said mask data for a match between said product and rules data corresponding to said one of said mask data; and

outputting said match to a function within said network device in order to perform said at least one network function.

15.   The method of claim 14, wherein said providing step includes a step of sorting data in said masks table, said rules table and said pointers table numerically, and said searching step includes searching said rules table with a binary search.

16.   The method of claim 14, further comprising a step of looping through each of said masks data and performing each step for each of said masks data in order to determine matches between said product for each of said masks data and said data packet with said corresponding rules data.

17.   The method of claim 14, wherein said search step includes a step of calculating parameters of said binary search based on said maximum and minimum address data.

18.   The method of claim 18, wherein said calculating step includes calculating a number of steps for said binary search, a initial address for said binary search, and a delta for each of said number of steps.

19.   A network device comprising:

at least one network port;

a masks table means for containing filter information and a mask key;

a rules table means for corresponding rules to said filter information and being related to said masks table by said mask key;

a pointers table means for containing boundary data related to said rules for corresponding filter information; and

a fast filter processor means for coupling to said mask table, to said rules table and to said pointers table, and for performing at least one binary search for at least one rule related to a data packet received by said network device at said at least one network port, said binary search being limited based on said boundary data in said pointers table.

20.   The network device of claim 19, wherein said filter information in said rules table means is sorted in order, said pointers table means contains addresses of maximum and minimum rules in said rules table means for each specific mask key value, and wherein said fast filter processor means is for calculating parameters of said at least one binary search based upon said

addresses of maximum and minimum rules in said rules table for each specific mask key value.

21. The network device of claim 20, wherein said fast filter processor means is for receiving said packet and AND said packet with at least one of said filter information related to a single mask key to generate a product, calculating the parameters of said at least one binary search based upon said addresses of maximum and minimum rules in said rules table means for said single mask key value, and retrieving at least one rule from said rules table based on the results of said at least one binary search based on said product.

22. The network device of claim 19, wherein said fast filter processor means comprises semiconductor-based processor components.

23. The network device of claim 21, wherein said fast filter processor means is configured to loop through every mask key for said filter information, to AND each of said filter information with said packet, to initiate a binary search for each product, and to store all results of each said binary search.

24. The network device of claim 19, further comprising:
a processor means coupled to said fast filter processor means, said

rules table means, said masks table means and said pointers table means, and configured to store and maintain data in said rules table means, said masks table means and said pointers table means, and to create said minimum and maximum address information in said pointers tables means based on inserts and updates to said masks tables means or said rules tables means.

25. The network device of claim 20, wherein said parameters include number of search steps, search start address and delta per step.

26. A fast filter processing circuit, comprising:

a rules table means having an input and output, and for storing rules related to a network function;

a masks table means having an input and output, and for storing masks related to said rules;

a pointers table means having an input and output;

a signal generator means coupled to said masks table means and said pointers table means, and for generating a next mask signal;

a multiplier means coupled to the output of said masks table means and to a data packet input means, said multiplier means for multiplying a mask output from said masks table means and a data packet input from said data packet input means and outputting a product of said mask and said data packet;

a comparator means coupled to the output of said rules table means and the output of said multiplier means, and for comparing said product with a rule output from said rules table means and generating a comparison signal;

a multiplexer means having a plurality of data inputs and a control input, said control input coupled to an output of said comparator means, said multiplexer for outputting an address signal being one of said plurality of data inputs based on said comparison signal input to said control input;

a feedback loop means coupled to the output of said multiplexer means and the input of said rules table means, to a first input of said comparator means, to a subtractor means and to an adder means;

wherein data in said pointers table means defines a number of steps for a search and a starting address for said search, said subtractor means subtracts a jump value from an input and outputs an address less than a current address by the jump value to a second input of plurality of data inputs of said multiplexer means, said adder means adds said jump value to an input and outputs an address greater than a current address by the jump value to a third input of plurality of data inputs of said multiplexer, and said circuit outputs said output of said rules table means, such that a rule matching said data packet based on said mask is output of said circuit.

27.   The circuit of claim 26, wherein said multiplier means comprises an AND gate.

28.   The circuit of claim 26, wherein said comparator means is configured to output a first comparison signal when said rule and said data packet input to said comparator means match, and said multiplexer means is configured to output a signal from a first input of said plurality of data inputs, said first input signal being a current address of said search.

29.   The circuit of claim 26, wherein said comparator means is configured to output a second comparison signal when the value said rule input to said comparator means is less than the value of said data packet input to said comparator means match, and said multiplexer means is configured to output a signal from a second input of said plurality of data inputs, said second input signal being a next address of said search.

30.   The circuit of claim 26, wherein said comparator means is configured to output a third comparison signal when the value said rule input to said comparator means is greater than the value of said data packet input to said comparator means match, and said multiplexer means is configured to output a signal from a third input of said plurality of data inputs, said third input signal being a next address of said search.

31.   The circuit of claim 27, wherein when said rule and said data packet match, said rule output of said circuit is held at a current rule for said current address for a remainder of search steps.